Drell-Yan and J/ψ production in high energy proton-nucleus and nucleus-nucleus collisions *

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The distributions of outgoing protons and charged hadrons in high energy proton-nucleus collisions are described rather well by a linear extrapolation from proton-proton collisions. This linear extrapolation is applied to precisely measured Drell-Yan cross sections for 800 GeV protons incident on a variety of nuclear targets. The deviation from linear scaling in the atomic number A can be accounted for by energy degradation of the proton as it passes through the nucleus if account is taken of the time delay of particle production due to quantum coherence. We infer an average proper coherence time of 0.4 ± 0.1 fm/c from fitting pA Drell-Yan pair production as shown in Fig.1.

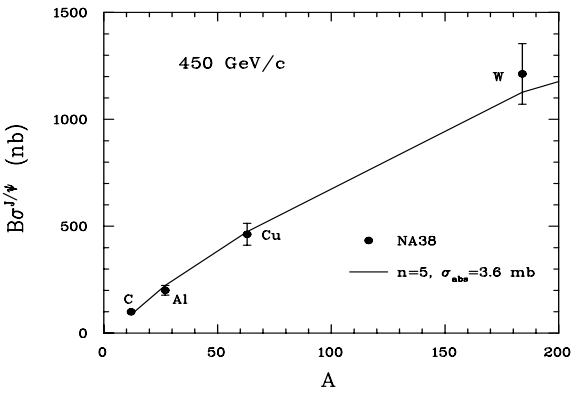

Figure 1: Branching ratio into muons times cross section to produce J/ψ with $x_F \geq 0$ in proton-nucleus collisions at 450 GeV/c. The data is from NA38.

Then we apply the linear extrapolation to measured J/ψ production cross sections for 200 and 450 GeV/c protons incident on a variety of nuclear targets. Our analysis takes into account energy loss of the beam proton, the time delay of particle production due to quantum coherence, and absorption of the J/ψ on nucleons. The best representation is obtained for a coherence time of 0.5 fm/c, which is consistent with Drell-Yan production, and an absorption cross section of 3.6 mb, which is consistent with the value deduced from photoproduction of the J/ψ on nuclear targets.

Finally, we compare to recent J/ψ data from S+U and Pb+Pb collisions at the SPS. The former are reproduced reasonably well with no new parameters as shown in the following figure but not the latter. A systematic exploration of the freedom allowed by present parametrizations of the nucleon-nucleon experimental data is called for. It may be that after a more thorough treatment, the need for a picture with J/ψ absorption on "co-movers" will emerge here also. This, and the issues are being investigated.

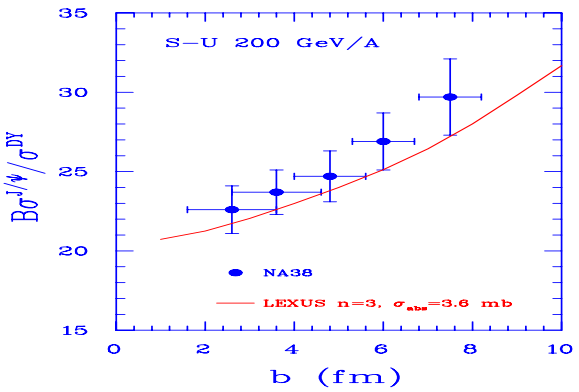

Figure 2: Branching ratio into muons times cross section to produce J/ψ with $x_F \geq 0$ in proton-nucleus collisions at 450 GeV/c. The data is from NA38.

Footnotes and References

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